



Australia's National
Science Agency

Communities in Transition

Rockhampton: A Living Transitions Roadmap



The economic development
unit of Rockhampton
Regional Council

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Summary

This report is a living roadmap designed to support the Rockhampton Region in securing a prosperous and sustainable future. The roadmap is developed as part of the Clean Growth Choices: Communities in Transition (CiT) project through active participation of the Rockhampton Regional Council, community members and a local coordinator. This project is supported by a consortium from the University of Southern Queensland, James Cook University, CSIRO and The Ecoefficiency Group. The Clean Growth Choices project has been funded by the Queensland Government as part of its CiT pilot program.

A three-stage process was implemented in this project:

1. Assessing the current state, risks, challenges and opportunities for the region and identifying broad pathways for the future.
2. Generation and rapid evaluation of innovative ideas and options that enable the development of broad pathways.
3. Putting options and pathways into a transition roadmap and for developing business cases.

The three-stage process was carried out through a series of meetings, workshops, webinars and other activities with Regional Council leaders and community members (Figure 1).

In a workshop process, key challenges were identified for the region including: a) major economic challenges, b) extreme weather events including cyclones, floods, fires and heatwaves, c) changing environmental and climate risks, d) increasing legislative, financial and insurance requirements, e) supply chain, consumer and shareholder pressures, f) low numbers of local businesses and slow business growth rates, g) lower than national average levels for education, employment and health, and h) capacity and retaining of youth and community leaders.

Key strengths and opportunities identified for the region include: a) a coastal subtropical climate with mild winters, b) great natural assets for diverse economic activities including a steady water supply, important mineral deposits, abundant solar energy and good agricultural land, c) high ecological values with varied landscapes, d) emerging effective waste management and recycling opportunities, e) an outdoor lifestyle

through agriculture, mining, sports and recreation, f) a laid-back relaxed lifestyle and a unique rural character, g) a strong 'sense of place' and 'sense of community', h) a strong Indigenous culture and a long and rich Indigenous and non-Indigenous history, and i) strong governance associated with catchment and landscape planning.

Goals identified highlight the desire for the region to be a great place to live, work, play, learn and invest now and in the future; where the community is empowered; the natural environment is protected, maintained and enhanced; and sustainable industries and infrastructure are built.

The workshop community identified several broad transition pathways, and proposed an initial set of interventions, mechanisms and outcomes through which the goals could be achieved. These are:

1. **Tourism and Recreation Revival:** focus on environmental, river, historic and Indigenous features
2. **Flood Resilience:** a new focus on floodplain management and reef ecosystems
3. **Outward Bound:** new supply chain opportunities through airport internationalisation
4. **New Circular Economy:** turbo-charging support for dynamic business and eco-efficiencies
5. **Aquaculture Boom:** building on aquaculture opportunities towards a zero emissions sector
6. **Making Water Work:** preparing the ground for low-impact agriculture, including biofuels

These pathways are complementary and have phases that can be implemented to maintain, modify and transform parts of the region to achieve the community's goals. Key cross-cutting interventions are required to enable these pathways, including: (1) building digital inclusion, (2) reliable, secure forms of energy including renewable energy, and (3) effective waste management and recycling.

An initial business case has been developed to set the roadmap in motion; *Making Water Work for Rockhampton – Delivering greater benefit from new agricultural water, supply chains and value chains.*

This report is an initial step in developing a dynamic and living roadmap for regional communities in transition. It will require further work to test and refine the details of the proposed pathways. It will also require ongoing

monitoring and reviewing at least every two years to ensure that the set of pathways remains appropriate and sufficient to achieve the vision and goals and are robust enough to changes in global and domestic drivers.

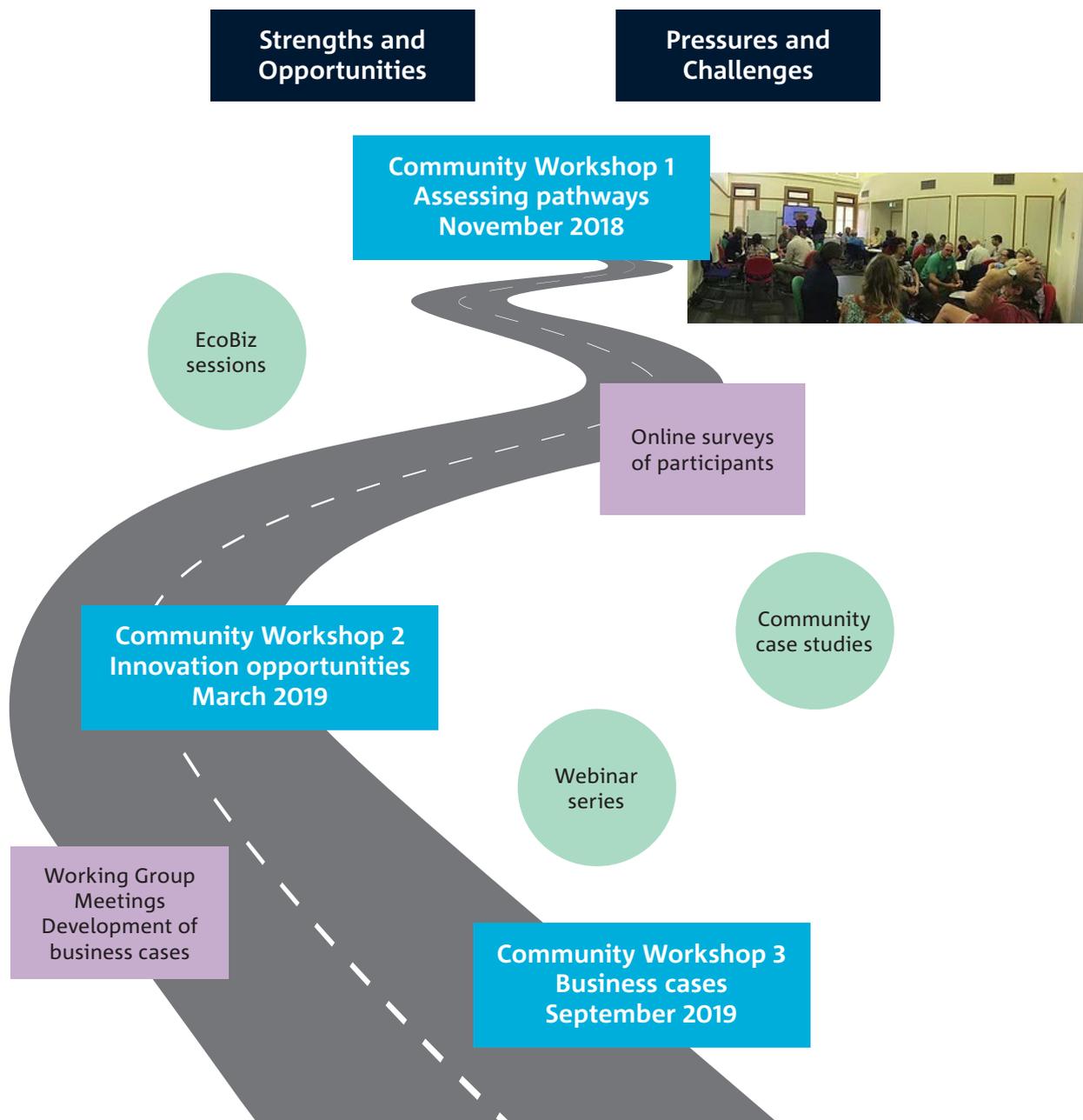


Figure 1. The stages of the program leading to development of the roadmap and business cases.

1 Background

A team from James Cook University (JCU), University of Southern Queensland (USQ), Commonwealth Scientific and Industrial Research Organisation (CSIRO), and The Ecoefficiency Group (TEG) designed a program of work in response to a Queensland Government tender for the delivery of a pathways approach to its Queensland Climate Transition Strategy, *'Pathways to a clean growth economy,'* a strategy that focuses on the risks associated with environmental, social and economic changes. The Queensland Government anticipates that the economy will need to keep adjusting to stay in step with the changing global economy. It assumes that Queensland has a competitive advantage that will assist with the transition, and while the transition will likely occur over decades, it should start right away to be most cost-effective. The State government has said that it will assist and guide these processes by:

- Creating an environment for investment shift and innovation.
- Facilitating existing Queensland industries to transition.
- Working with Queensland's regional communities to transition.

The dynamics of transition is complex and challenging. Transition needs to be led by the communities themselves in ways that are socially acceptable and build collective agency in shaping the future.

This report focuses on the development of an initial living transition roadmap for the Rockhampton Region as part of the *Clean Growth Choices: Communities in Transition* (CiT) pilot program. The program is an active community capacity building process for strengthening regional leadership and resilience in dealing with economic, social and environmental change. It is helping Queensland regional communities to organise and process what is involved in transitioning over the intermediate to long term to achieve a more sustainable economy by:

- Referring to values, visions and plans to guide each community.
- Drawing on existing networks, knowledge, skills and capabilities.
- Canvassing current pressures, opportunities and future scenarios and visions.
- Identifying broad pathways and multiple options for transitioning and achieving the goals.
- Developing dynamic and future-focused roadmaps and identifying an initial set of business cases that set the roadmap in motion.

The project team is drawn from a collaborative consortium comprised of experts who help communities, businesses and governments develop community resilience strategies. The project team includes, The Institute for Resilient Regions at USQ, The Cairns Institute at JCU, CSIRO Sustainability Pathways Program and The Ecoefficiency Group.

With advice from the Rockhampton Regional Council, the project team worked closely with community members to develop an initial transition roadmap and a few business case proposals. With more detailed work, a fully developed roadmap will assist the community with navigating future uncertainties and changes.

2 Developing transition roadmaps

The Communities in Transition (CiT) program provides a framework for communities to create roadmaps, set their own directions, navigate their own pathways, and design interventions conceived and implemented by the participants themselves. The roadmap development process was informed by the Resilience Adaptation Pathways and Transformation Approach (RAPTA) (O’Connell et al. 2016) and was modified to suit this context (Maru et al. 2018). RAPTA is a design approach to bring best practice in the formulation of programs, projects and other interventions so that they achieve the desired outcomes. The three-stages of the transition planning process is summarised below.

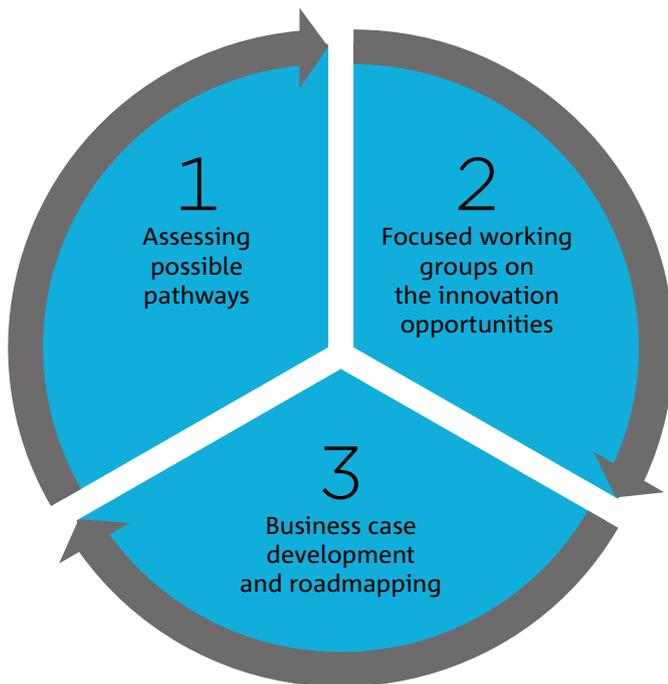


Figure 2. The three stages of the transition planning process.

Stage 1: (Sep – Dec 2018) Assessing the broad pathways to the future

The process started with an assessment of each region’s current state, reflecting on community values, heritage and aspirations, and tabling future opportunities and risks. This phase ended with the Broad Pathways Workshop which discussed the region’s past, present and future. Participants examined the regional profile as well as key challenges and opportunities prepared by the project team and identified possible broad pathways for the future.

Stage 2: (Jan – Jun 2019) Focused working groups for innovative ideas and options

Working groups were formed around the domains of focus that were identified in the broad pathways in Stage 1. As part of this stage, the consortium helped the teams draw on some of the new techniques to rapidly evaluate the real potential of the ideas as well as the enablers needed to overcome barriers and increase chances of success. At the end of this stage, each team had scoped a range of new ideas, settled on the ones that were most likely to be successful, and planned a staged implementation (a ‘pathway’) including actions to address related enablers and barriers.

Stage 3: (Jun – Oct 2019) Creating transition roadmaps and building business cases

Results from the focused working groups were brought together into a single regional community ‘roadmap’ of projects. The consortium assisted the teams to identify pathways of interdependent actions, plan the timing of these actions and identify ‘trigger points’ – things to monitor over time that should stimulate a review of the roadmap and could potentially change an action. The consortium also supported the community teams to scope short-term priorities and prepare a few initial business cases to set the roadmap in motion.

3 Rockhampton regional profile

Current state of the region

The Rockhampton Local Government Area is 6,570 km² in size and is dominated economically by beef grazing and coal mining. The area extends to the coast at Keppel Bay in the Great Barrier Reef World Heritage Area. To the north of the region is the Livingstone Shire Council, to the south are the Gladstone Region and the

Banana Shire, and to the west is the Central Highlands Region. The largest city in the region, Rockhampton, is located beside the Fitzroy River about 600 km north of Brisbane. Rockhampton is an economic, cultural and administrative hub for Central Queensland (Figure 3).

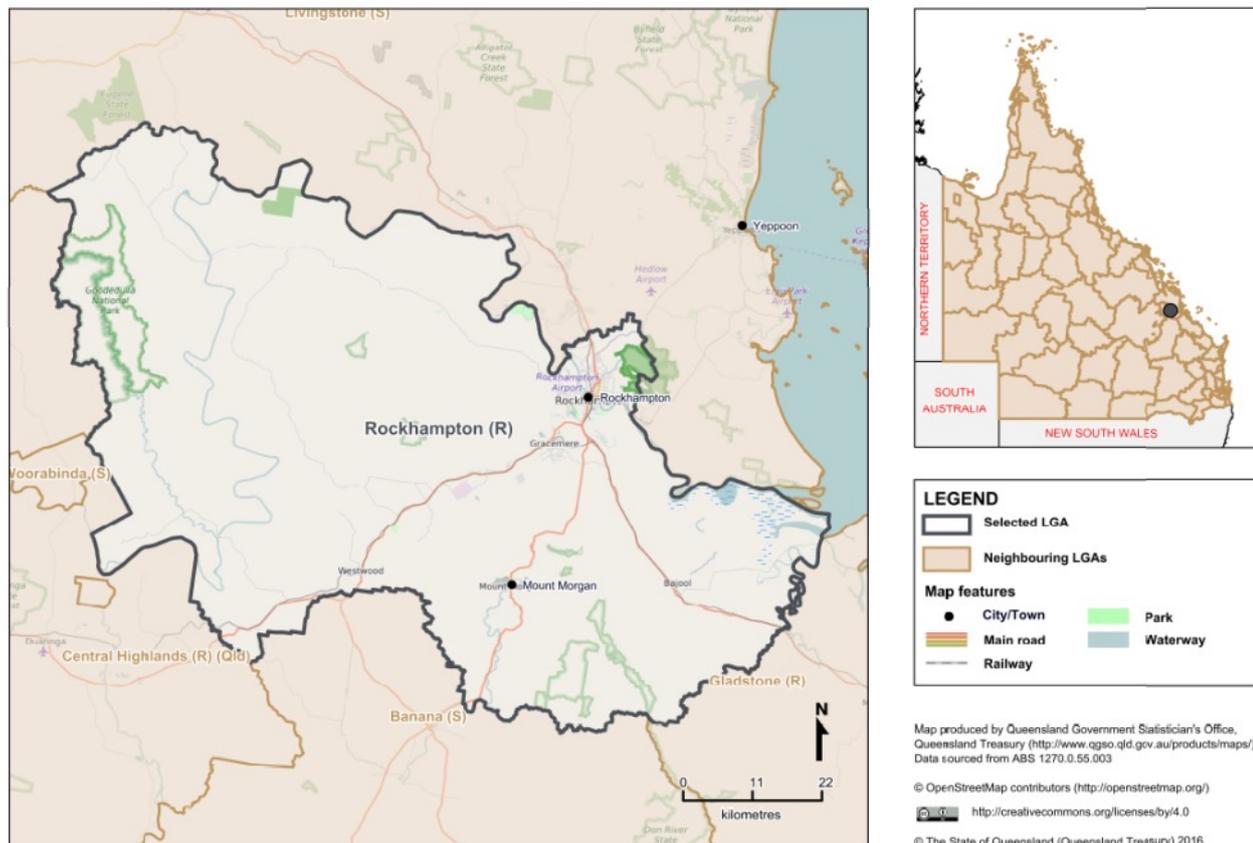


Figure 3. Rockhampton Region (Source: QGSO 2019).

Population composition and dynamics

The 2018 estimated resident population for the Rockhampton Local Government Area was 81,067. Average annual population growth declined in the preceding five years, at a rate of -0.2%, but averaged 0.6% over the past decade (QGSO 2019). The population is projected to increase to 104,153 by 2041, at a rate of 1% per year (QGSO 2019). More than 7% of the region's population is Indigenous (QGSO 2019). In June 2017, 14.7% of the population were older than 65 years compared with 15% for Queensland overall. A total of 64.2% were working age (15–64 years old), compared with 65.3% for the state (QGSO 2019). In the 2016 census, 82.7% of the population were born in Australia (QGSO 2019).

Landscapes and livelihoods

The region's climate is subtropical, and is characterised by hot, moist summers and warm, dry winters. The region has an average daily temperature that ranges between 16.4°C and 28.0°C and an average annual rainfall of 790 mm. Because the annual average potential evaporation is more than twice the annual average rainfall, the area's soils are quite dry (QDEHP 2016). Rockhampton has a reputation for being Australia's 'beef capital' and as a logistics and forward deployment base for the Shoalwater Bay Military Training Area. Rockhampton is also known as a major hub for education, health and transport. In 2016, the top five industries for employment were: Health Care and Social Assistance (15.1%), Retail Trade (10.6%), Education and Training (9.8%), Construction (7.2%), and Accommodation and Food Services (7.2%) (QGSO 2019). The gross regional product was estimated to be approximately \$4.83 billion in the year ending June 2018, supporting around 42,674 jobs, but declining -0.5% since 2017 (NIEIR 2018). Unemployment was 7.4% at the end of the March 2019 quarter (QGSO 2019).

4 Challenges and opportunities

In conversations held with workshop participants and Rockhampton Council members, a number of challenges and opportunities facing the region were identified. These are outlined below in the context of current literature.

Governance, social and economic challenges

The Rockhampton Region faces a number of fundamental challenges which underpin its ability to respond to other pressures and opportunities. Challenges include social and health issues (e.g. obesity and drug use), youths leaving the region for study or employment, a lack of facilities and support for community organisations (e.g. for multicultural groups), and unemployment and skill levels (53% with a non-school qualification, e.g. degree or diploma, compared with the state average of 59%) (QGSO, 2019). The region also has fewer local businesses and small to medium enterprises and slower rates of business formation and growth than many other regional centres (RPS Australia East 2016). The economic performance may be explained in part by slow consistent growth rather than the boom-bust cycles evident in other regional centres.

To overcome these challenges, the region (mainly through the Council) is applying prudent economic policies and planning to strengthen partnerships and to take advantage of new opportunities. It is also investing in infrastructure and the development of local skills to stimulate economic activity, and promote the region's strengths, lifestyle and opportunities to attract investment and people (Empower Economics 2016). The Council is also focusing on future-oriented jobs through innovation and improved community services (RRC 2018a).

Several other issues were noted; an expanding urban population leading to habitat loss, pressure on infrastructure, changing community character, and a lack of land for affordable development. Added to this is an emphasis on jobs and growth at the expense of the environment. Added to this are perceptions of 'imposed regulations' from city-based governments resulting in poor infrastructure (e.g. flood prone roads beyond the highways) and limited air links. Competition with other Central Queensland regions and towns is high, resulting in patch protection, a situation that requires improved collaboration between local councils, government agencies and industry.

Climate and extreme weather events

In recent years, Queensland summers have brought an increase in severe storms and floods, droughts, heatwaves and bushfires across the state. Climate change is likely to exacerbate the frequency and severity of these events (QDEHP 2016). In 2015, the region was battered by Tropical Cyclone Marcia, passing Yeppoon as a Category 4 system before moving over Rockhampton as a Category 2 system and causing at least \$750 million in damage (CGCC 2019).

In coming years, it is predicted that the Rockhampton Region will experience more severe storms and intense downpours, higher average temperatures, higher risk of fires and drought, and more frequent floods (RRC 2018b; QDEHP 2016). Extreme events can affect ecosystem health, industries and settlements, disrupting access to water, sewerage, storm water, transport and communications services. Evidence suggests that climate stresses can impact physical and mental wellbeing and strain social support services and key infrastructure in regional, rural and remote parts of Australia (Hossain et al. 2014). The cost of insurance may also increase as a result of climate change (QDEHP 2016).

As evaporation rates increase with higher temperatures, there will likely be higher rates of soil moisture depletion, reduced ground cover and lower livestock carrying capacity. A changing climate presents some opportunities for the region's agricultural sector. Warmer wet seasons may increase pasture growth and increase soil fertility by increasing plant decomposition and nitrogen availability. Additionally, higher levels of atmospheric carbon dioxide may increase pasture water efficiency and nitrogen uptake, although this could be offset by an overall reduction in pasture quality (lower protein and lower digestibility) (Cobon et al. 2017).

Tourism and recreation

The region has about 30% of its original vegetation still intact, and includes extensive wetlands, creeks and river systems (RRC 2018b) enabling recreational activities such as barramundi fishing and river cruises. National Parks, including Mount Archer, and access to the coast and islands are also attractions. Several events draw local residents and tourists to the region, such as the Rockhampton River Festival which celebrates the Fitzroy River and promotes the areas' arts, culture, entertainment and food (RRC 2018c). The Dreamtime Cultural Centre is built around reconstructed sandstone caves containing the traditional ceremonial rings of the Darambul people and houses a retail outlet, storage for valuable and sacred material, training facilities, office space, conference facilities, art gallery and a cultural museum (RCC and CQACCA 2018). The Tropicana gardening and sustainable living expo is an annual 'eco-do-fest' held at the Rockhampton Botanic Gardens (RRC 2018d). Another event of note is Talisman Sabre, the Commonwealth Department of Defence's biennial military training activity, which is the largest combined Australia and USA military exercise undertaken by the Australian Defence Force and in 2017 it involved over 30,000 participants (RRC 2017b).

Communications and technology

New telecommunications services emerging across Australia provide access to services previously unavailable to rural and remote communities. For example, telehealth can assist in the long-distance diagnosis, treatment and prevention of disease and injuries, providing clinical support and improved health outcomes by connecting patients and clinicians who are in different locations (Bradford et al. 2015). However, communication technologies rely on certain levels of infrastructure and equipment such as the internet, computer and videoconferencing systems, but these can be expensive and poorly maintained in remote locations. Rockhampton is emerging as a 'Smart Regional Centre' using real-time data to help improve public services, grow employment, and improve community vitality (RRC 2018a). In March 2018, Telstra announced \$18 million in telecommunications projects for Central Queensland to deliver new or improved mobile coverage for Central Queensland communities. Funded projects include an extension of the Internet of Things (IoT) capabilities, connecting devices and apps to new and innovative technology. For example, agriculture apps that access IoT sensors that let farmers measure soil moisture for crops and trees (Mesner 2018).

Consumer pressures

Cattle grazing dominates the agricultural industry in the Rockhampton Region where there is renewed interest in buying local beef. The region's terrain, however, is suited to breeding rather than fattening, resulting in tougher meat that can be rejected by domestic and overseas consumers. Most cattle from Central Queensland are sent to feedlots elsewhere, then the beef is sent to Brisbane and mostly exported. In recent years, the problem of retaining local beef has been resolved by one grazing family who grows barley sprout and feeds it to their cattle in small feedlots. Another issue is the sale of local beef to local restaurants, which is much easier for large-scale suppliers, because they can sell secondary cuts to other buyers as mince or sausages. A few Rockhampton restaurants now buy locally produced high-quality organic beef (Terzon 2018). Because it was financially difficult to expand their beef business, one Central Queensland farming couple discovered aquaculture, and use wastewater from their barramundi tanks to irrigate grazing pasture, improving cattle stocking rates. Electricity, liquid oxygen and feed are the three main cost items, but it is profitable due to high turnover rates and high consumer demand for barramundi in Brisbane and Sydney (McCosker 2016).

Energy

Fundamental changes occurring in the energy sector make solar energy increasingly relevant to the region given its favourable climate. Plans are underway for the development of solar energy generation facilities for the Glenmore Water Treatment Plant (Bulloch 2017).

In 2015, Teys Australia's abattoir in Rockhampton installed a wastewater treatment plant with a covered anaerobic lagoon which treats liquid waste from the plant and captures methane-rich biogas which is then used in boilers replacing natural gas and coal as a fuel source. The abattoir has offset 20% of coal consumption required for steam demand (Tey Australia 2015). The wastewater

treatment plant won the Premier's Business Eco-Efficiency Award for outstanding performance in improving its operational efficiency by applying environmentally beneficial processes and the Premier's Energy and Sustainability Award for forward thinking on good energy practices and sustainability (Tey Australia 2015).

Rockhampton City Council participates in a number of other initiatives to reduce carbon emissions including the Queensland Climate Resilient Councils Program and the Rockhampton Region Planning Scheme amendments to review advice, science and policy on climate change adaptation and renewable energy provision. A number of investigations have occurred into the feasibility of energy efficiency and renewable energy initiatives, as well as reducing CO2 emissions through the use of diesel and hybrid-powered vehicles, and an energy-efficient water pumping and treatment project (RRC 2017a).

Water

The Fitzroy River, which empties into the Great Barrier Reef lagoon, is the largest river catchment flowing to the east coast of Australia (RRC 2018b). The Fitzroy River, together with numerous smaller rivers and creeks are a reliable source of water for domestic use, agriculture and other industries. The environmental impacts of these industries pose a major challenge as sediment, pesticide and herbicide levels in the coastal waterways and lagoon can affect the distribution and abundance of coral and other marine organisms (Marsden Jacob Associates 2013). Future pollutant loads could increase, given the agricultural intensification outlined in the Queensland Government plan to double the value of agricultural production in the state by 2040. These plans have identified the Fitzroy River Agricultural Corridor for intensive agriculture development, with water supplied from the new Rookwood Weir (RDAFCW 2018). The weir will also enable a backup supply of water for Gladstone, Rockhampton and the Livingstone Shire (RDAFCW 2018). New infrastructure is

planned to improve flood mitigation of the Fitzroy River, as periodic flooding in the region has led to significant damage to buildings, houses, agricultural production and transport infrastructure (RRC 2018e; RRC 2020).

A number of small-scale measures are in place to encourage increased water efficiency, improve quality and ensure security. Rockhampton Regional Council offers residents a rebate for installing water-efficient products (RRC 2018f). The wastewater treatment plant at Teys Australia’s abattoir uses a Biological Nutrient Removal System to improve wastewater quality, allowing for a greater number of potential reuse opportunities (Teys Australia 2015). The diesel generator at the Glenmore High Lift Water Pump Station is capable of supplying backup power to the entire water treatment plant, and pumps enable a continuous and reliable supply of water to the community in times of extreme weather and other emergencies (Dickers 2016).

Waste

Rockhampton Regional Council has a Waste Reduction and Recycling Plan which provides a framework for the collection, treatment and disposal of waste generated within the region, sets long-term targets to minimise landfill, sets out a strategy to maximise the recovery and reuse of waste, and ensures ongoing compliance with legislation. Within the region, there are two landfill areas, four waste transfer stations, nine roadside bin stations and the Central Queensland Material Recovery Facility which also serves neighbouring councils (RRC 2016).

Challenges identified by workshop participants

Workshop participants discussed key challenges and opportunities facing the Rockhampton Region now and in the future. These are summarised in Table 1.

Table 1. Challenges and opportunities.

CHALLENGES	OPPORTUNITIES
Climate/extreme weather conditions – floods, heat, cyclones	Coastal subtropical climate with mild winters
Changing environmental risks, including climate risk, changing government policies and consumer and shareholder pressures	Great natural assets for diverse economic activities – steady water supply, important mineral deposits, abundant solar energy, good agricultural land
International trading hampered by political and/or practical barriers affecting trade	High ecological values with a varied landscape
Below average numbers of local businesses, slow business formation and growth rates	Outdoor lifestyle – agricultural, mining, sports and recreation
Population with lower than national average educational, employment and health characteristics	Diversifying from traditional focus on beef, exploring new products and industries
Perceptions by some of ‘imposed regulations’ from cities in the south	Strong governance associated with catchment and landscape planning
Maintaining community leadership and capacity	Container Refund Scheme (CRS) – economic opportunities, litter reduction
	Laid-back relaxed lifestyle and unique character
	Both Indigenous and non-Indigenous history adds to ‘sense of place’
	Rich Indigenous culture – local Traditional Owners hold key information about country/culture
	Strong ‘sense of community’ across the region

5 Values and goals

Values

Values were discussed in at the first workshop, not in terms of assets but what people valued about Rockhampton. There was a clear consensus on values such as diversity of the economy, liveability, collaborative willingness, relative safety, relationships and connections, social and cultural diversity, resilience and pragmatism, a sense of belonging, and a sense of Rockhampton being neither too big nor too small. This echoed the values expressed in the Rockhampton Regional Council's Corporate Plan 2017–2022.

Goals

Goals identified highlight the desire for the region to be a great place to live, work, play, learn and invest now and in the future; where the community is empowered; the natural environment is protected, maintained and enhanced; and sustainable industries and infrastructure are built.

6 Priorities and pathways

Priorities

To develop a transition roadmap, it is important to consider the challenges and opportunities that the region could face now and into the future. There is inherent uncertainty around some of these challenges and opportunities, how they interact, and how they may change over time. This uncertainty requires that transition pathways that are developed are robust yet flexible in order to build a prosperous, sustainable and equitable region into the future.

Based on discussions of current strengths and future opportunities and taking into consideration some of the challenges identified earlier, the workshop participants identified nine areas for building broad pathways to a prosperous and resilient region. These are:

1. Tourism and Recreation Revival: focus on environmental, river, historic and Indigenous features
2. Flood Resilience: a new focus on floodplain management and reef ecosystems
3. Outward Bound: major new supply chain opportunity through airport internationalisation
4. New Circular Economy: turbo-charging support for dynamic business and eco-efficiencies
5. Aquaculture Boom: building on aquaculture opportunities towards a zero emissions sector
6. Making Water Work: preparing the ground for low-impact agriculture, including biofuels
7. Telecommunications
8. Ecosystem services
9. Waste management.

After considering some of the risks and uncertainties around each project, the nine areas were refined to six priority areas for building broad pathways to a prosperous and resilient region (Figure 4).

Broad pathways

The six priority areas were further refined and merged to create three broad pathways for further development:

1. Rockhampton as a centre for low-impact agriculture through Making Water Work, Outward Bound and Airport Internationalisation.
2. Protection, maintenance and enhancement of ecosystem services starting with ensuring Flood Resilience.
3. New Circular Economy starting with Tourism and Recreation revival and Aquaculture Boom.

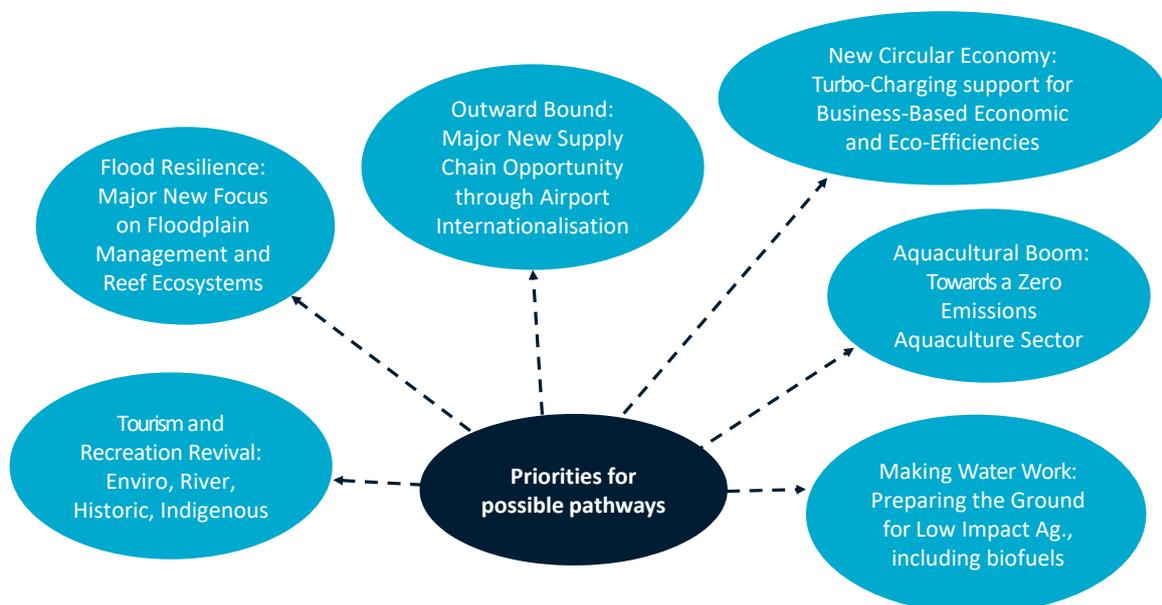


Figure 4. Six priority pathways contributing to broad transition.

7 Dynamic transition roadmap for the future

Types of change pathways

Each pathway will build and enhance existing resource use and livelihood systems in the region in the short term, modify some aspects gradually and even transform other aspects by radically changing and/or adding some significant new components into the regional economy. Therefore, it is possible to envisage each proposed pathway as having different stages or aspects to maintain, modify and transform the region that will require different types of interventions (Figure 5).

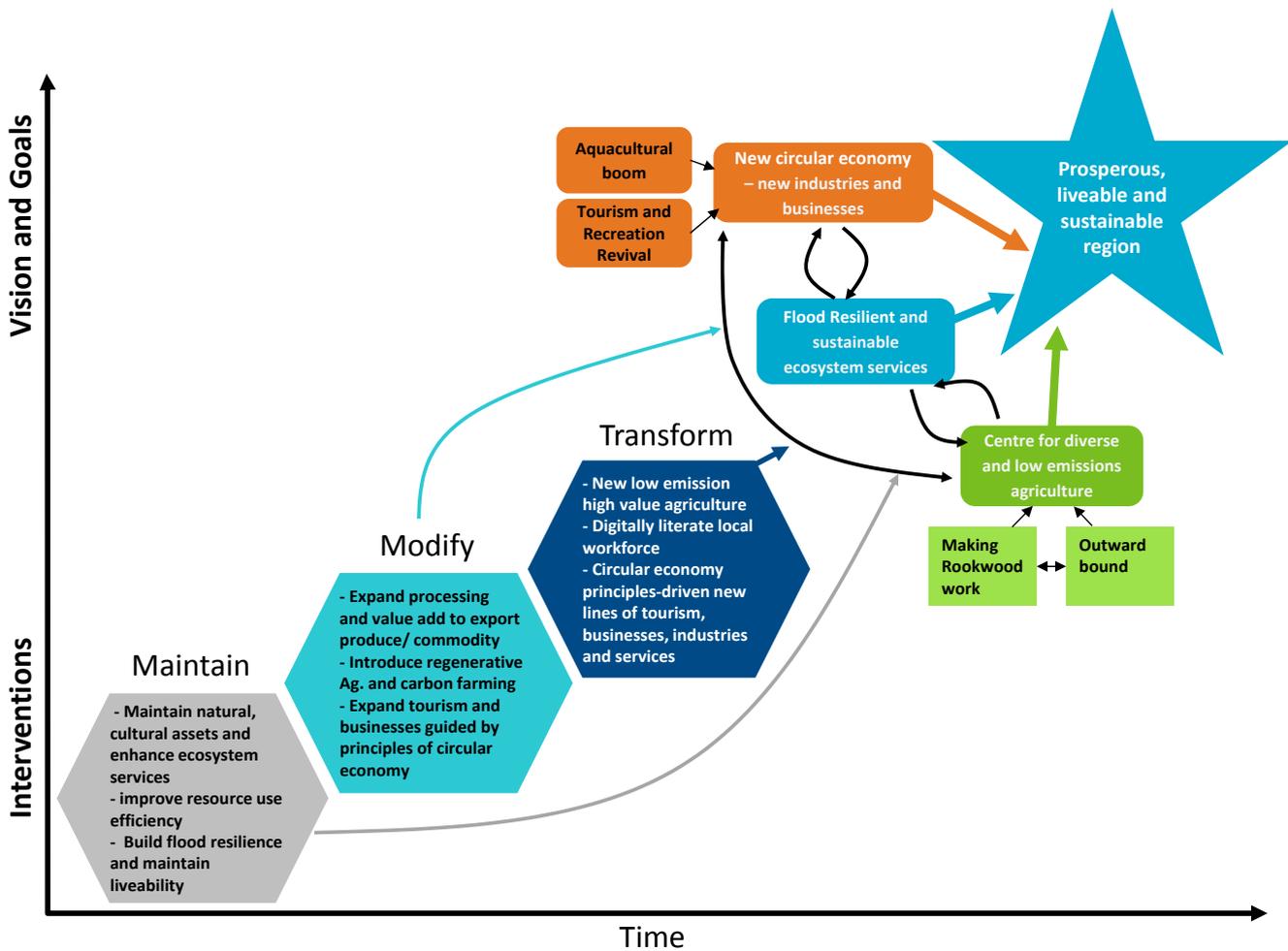


Figure 5. Broad pathways and priority interventions to build a prosperous, equitable and resilient region.

Table 2 shows potential focus areas of each stage to ‘maintain’, ‘modify’ and ‘transform’ aspects/phases of each of the three broad pathways.

Table 2. Potential focus areas of each stage in the three broad pathways to maintain, modify and transform aspects of the region.

BROAD PATHWAY	MAINTAIN	MODIFY	TRANSFORM
Rockhampton as a centre for low-impact agriculture through Making Water Work, Outward Bound and Airport Internationalisation	<ul style="list-style-type: none"> Maintain and expand existing livestock, crop industries and the rural lifestyle. Maintain existing road, rail and air transport. Maintain security of water access. Maintain liveability in the region based on values. 	<ul style="list-style-type: none"> Develop value added high-quality produce and commodities where possible. Expand and diversify transport networks. Ensure water security and trading functionality and efficiency of land use. 	<ul style="list-style-type: none"> Develop low-emission and circular agriculture. Develop new high-value horticultural products and food value chains. Create a new and well-networked supply and distribution hub. Become a region with integrated renewable energy, smart water uses and food production/processing and waste recycling.
Protection, maintenance and enhancement of ecosystem services starting with ensuring Flood Resilience	<ul style="list-style-type: none"> Build flood resilience. Reduce waste and emissions from businesses and industries. 	<ul style="list-style-type: none"> Expand and diversify existing biodiversity stewardship services and carbon farming. Adopt better environmental conservation goals. 	<ul style="list-style-type: none"> Identify and generate new business in ecosystems services.
New Circular Economy starting with Tourism and Recreation revival and Aquaculture Boom	<ul style="list-style-type: none"> Promote circularity in existing industries, businesses and services to improve efficiencies in water, energy and other input, starting in tourism. 	<ul style="list-style-type: none"> Provide incentives for reducing use of inputs, materials, and energy and to encourage reuse recycling and money recirculation within the region. 	<ul style="list-style-type: none"> Establish new businesses and industries such as aquaculture to enable large-scale circularity of the economy for meeting current needs without compromising the ability of future generations to meet their needs.

Interventions across pathways

Three cross-cutting interventions were identified that could enable the realisation of the pathways:

1. **Digital connectivity:** Digital technology is expected to offer significant opportunities to improve efficiencies in existing businesses, industries and services as well as supporting the emergence of new ones. This will require building a digitally literate workforce and businesses as digital innovation will replace many low skill and repetitive jobs. All six transition pathways will require greater connectivity.
2. **Renewable energy:** The pathways will require expansion of affordable and renewable energy from different sources and across the region. This will be important for the region and the different industries to contribute to emissions reductions.

The construction and maintenance of these energy resources will provide employment opportunities, so developing local skills will be important. Solar farms built near Rockhampton will provide power for thousands of homes and businesses (Gately 2017).

3. **Integrated waste management:** Waste management still poses a problem for the region. For example, the major landfill site is located next the Fitzroy River, the second largest waterway in Australia. During large flood events there is the potential for contamination of the river water by waste dumped at the site.

To enhance visualisation of the broad pathways, Figure 6 shows strategic interventions that will maintain, modify and transform aspects of the Rockhampton Region to realise the vision and goals.

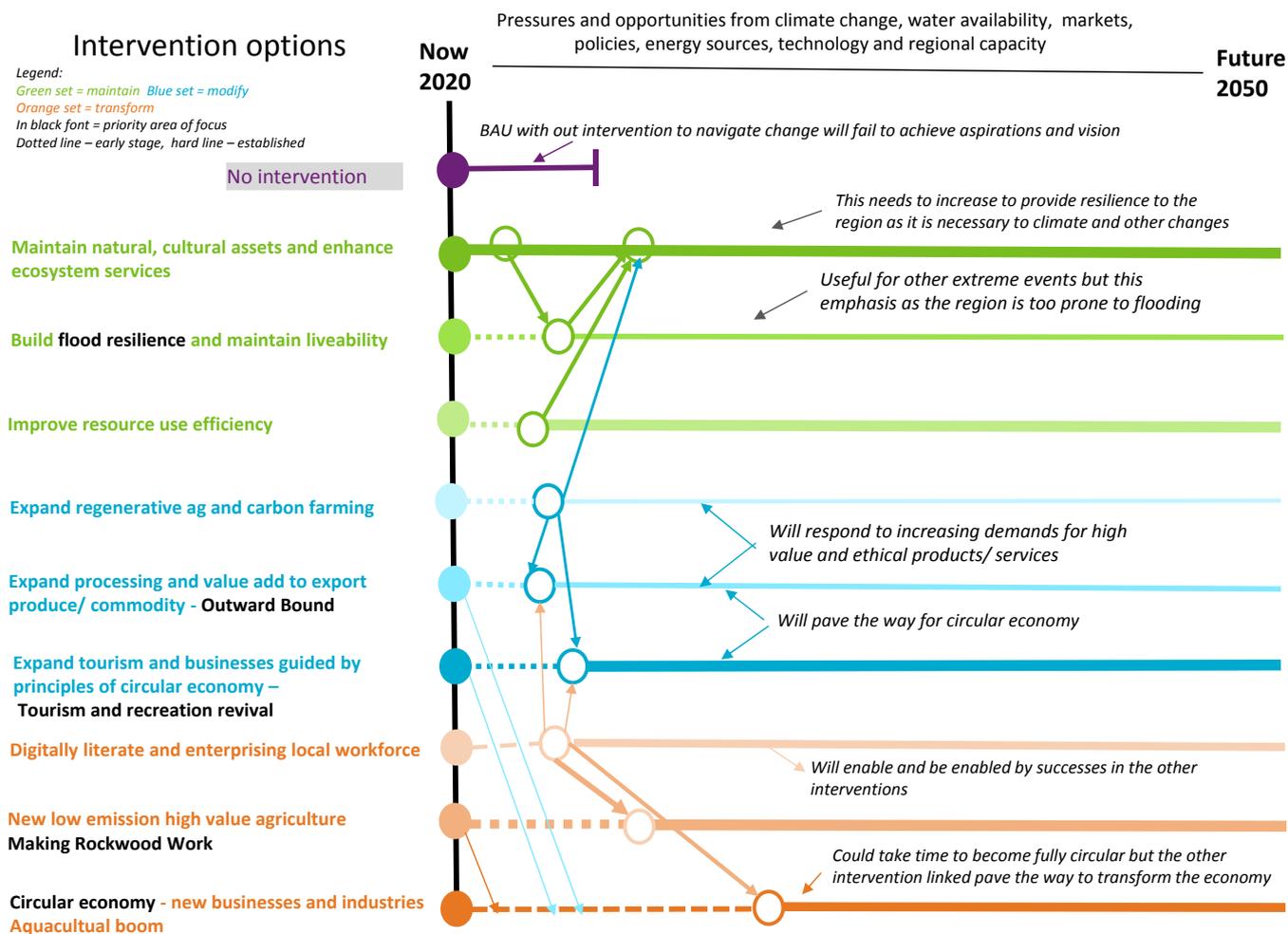


Figure 6. Sets of intervention options to ‘maintain’, ‘modify’ and ‘transform’ aspects of the region and their interdependencies.

8 Development of prefeasibility business cases

Implementing the priority pathway

To transition the region towards the desired future, each pathway will need an ensemble of intervention options (investment, policies, programs, projects and practice change) that are prioritised, sequenced and implemented. The pathways will also require mechanisms by which the challenges and opportunities can be addressed. The pathways need to be broad, alternative and complementary to allow for flexibility in addressing the uncertainty around how the challenges and opportunities may unfold in the future.

The Making Water Work pathway was identified as the priority pathway to be progressed within the resources currently available through the CiT program. To progress this pathway to a business case involved further community conversations, and an online survey of stakeholders to elicit their preferences for key components around options. The prioritisation was completed in a subsequent workshop (see Table 3).

The Making Water Work Pathway

A business case has been developed that focuses on identifying studies and interventions that could develop Rockhampton as a low-impact agriculture centre. In this sector, Rockhampton has many advantages over many other regions in Australia. For example, the region has suitable soils for irrigation and has the Fitzroy River catchment which is the largest freshwater river catchment on the eastern seaboard of Australia. The region is also well positioned to service significant growth in new agricultural commodities into near northern markets. At the same time, increasing water prices and declining water availability are driving renewed interest in development opportunities from other irrigation regions in northern Australia. Recent supply chain analysis in Townsville suggests significant unmet demand for agricultural products across key markets including South East Asia, China and the Middle East. Of relevance to Rockhampton, that work identified intensive beef cattle, onshore aquaculture, pulses and avocado as priority products, with nearly \$3 billion of currently unmet demand in global markets.

Table 3. Prioritised set of options for progressing the Making Water Work pathway.

OPTIONS AND PROJECT IDEAS	NO. OF RESPONSES
New forms of local, secure, affordable, dispatchable and low-carbon energy to drive agricultural growth	8
Visionary land use and infrastructure planning to reduce costs and impacts and strengthen supply chains	8
Next generation skills for a circular economy	5
Best management practices and regional composting for nutrient management and monitoring	4
More effective water trading and local management	4
New protected cropping systems and agricultural engineering and enabling substantive recycling	3
New forms of zero emission aquaculture and macro algae use as ameliorants	1
Water infrastructure development	1
Environmental credential systems	1
Stronger digital data hubs and value chain resilience and innovation	0

In a strong sign of the region's capacity to service these markets, and to further harness the economic opportunities from this water source, the Federal and Queensland governments have agreed to fund \$352 million towards the construction of the Rookwood Weir on the Fitzroy River. Rookwood Weir will deliver up to 42,000 ML of water to help generate agricultural industry development along with supporting urban and industrial growth and water security (76,000 ML in total). This will be in addition to the existing storages found between the Barrage and Rookwood Weir (Barrage 60,150 ML and Eden Bann Weir 26,260 ML). This will enable the transition of land use towards the production of priority demand-led products.

The Fitzroy Agricultural Corridor is the first major new irrigation development in Queensland for a generation, and achieving economic, social and environmental resilience will mean making every drop of water work hard for the Rockhampton community. The new development has the potential to bring international opportunities for the expansion of the next generation of value-rich horticultural, cropping and livestock developments. This new approach is needed as agricultural development comes with a series of challenges: regulations for water run-off from farms to achieve no net decline in Great Barrier Reef water quality; higher costs of infrastructure, energy, and farming input, and; consumer demand for increasingly high product standards.

Consequently, the most significant challenge for the development of agriculture will be effective management of water allocations to enable higher value and much more efficient, low-impact agricultural ventures and supply chains. The Making Water Work pathway explores, scopes and maps:

1. Agricultural supply chain visions and potential production system models.
2. Visionary land use and infrastructure planning that can deliver on this promise including innovative road, airport, port and communications solutions.
3. Integration with reliable, affordable and low-carbon energy options.
4. Catering for protected cropping, smaller scale farming and farm service innovations.
5. Next generation production system practices that meet the Great Barrier Reef regulations.

Combined with new supply chain, value chain and waste reduction and energy sector thinking, the opportunity exists for the region to lead the way in new and exciting developments in these approaches. New thinking and technologies present more opportunities to shift towards a circular economy and integrated and value-rich supply chains in the agricultural sector. These include new techniques in the design and management of new agricultural lands, nutrient extraction in aquaculture, and the potential for greater integration of feed production, soil enhancement and nutrient reuse between sectors. This Making Water Work pathway will focus a combined government, community and industry effort on identifying the opportunities, constraints and strategies to achieve this outcome

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Contact us

1300 363 400

+61 3 9545 2176

csiroenquiries@csiro.au

csiro.au

For further information

Land and Water

Dr Yiheyis T Maru

Principal Research Scientist

+61 2 6246 4171

yiheyis.maru@csiro.au

research.csiro.au/eap